

GROUP DISCUSSION TECHNIQUES IN A TECHNICAL COURSE

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Abstract: - *This paper will explain one instructor's use of the group discussion method of teaching in a technical course. The technique of group discussion as a teaching method is not new. Its use in technical courses, however, is uncommon. By noting the positive results from the use of this technique, the author suggests that others should consider it a teaching technique which increases students' interest and learning.*

Many articles exist regarding uses of small groups. They may refer to general use of groups in social situations, group discussions in social science/liberal arts classes, management (including TQM) techniques, or design teams (1,2,3,4,5). Although several computer and manual searches were done, the author has not found any references to the use of group discussion techniques used for classroom situations in technical courses. The use of group techniques presented here were put in place to solve a specific problem in the teaching of a technical elective, and may be useful to others.

The use of group discussion presented here was developed to solve a problem in EET 311, Biomedical Electrical Systems. This is a junior/senior elective in introductory medical instrumentation. Contents include such topics as electrosurgery units, dialysis units, and ECG electrodes. The time devoted to cardiac (heart-related) devices is six weeks. The first two weeks are spent on ECG monitors. The number of possible topics related to other cardiac diagnostic and therapeutic devices far exceeds the time available in the third through the sixth weeks. In an attempt to decide what to cover and to maximize student input, a variety of possible topics were listed at the end of the coverage of ECG monitors, and the students are asked to vote on which are their four favorite topics. An example topic list was:

- Pacemakers
- Defibrillators
- Artificial Hearts
- Heart-Lung Support During Open-Heart Surgery
- Ultrasound Imaging of the Heart (Echocardiography)
- Cardiac Output Measurements
- Computerized Arrhythmia Analysis
- Non-invasive Blood Pressure Measurements

Although this allowed the students some input into the course, it did mean the instructor had to do some fancy footwork to prepare up-to-date lectures on fairly short notice. The author also noted that students' attention didn't seem

any better even though they had "chosen" the topics for this part of the course.

After several years of this technique, the author realized that there must be a better way, as well as a way which might increase the students' attention. Partly as a result of a "Better Teaching" seminar by Prof. J. Michael Jacob, he decided to try group teaching during the four weeks of cardiac devices. The implementation of the technique had several requirements:

1. If the "choose your own topics" idea was to continue, material besides the text must be available to the students, due to the breadth of the topics, and due to the instructor's concept that all students in each group must actively participate in the work and discussions.
2. To prevent each group from having talkers/does and listeners/duds, the author felt there would need to be tangible effort from all members of the group.
3. If the groups were to choose their own topics, each group would need a separate test at the end of this section of the course.
4. The author knew the students needed to be "excited" about this section of the course if the group technique was to work, beyond just topic selection.

In an attempt to meet the above concerns, the group discussion was implemented in the following way:

- The class is broken up into groups of four or five, depending on class size.
- Each group selects four topics from a list of eight,, with each topic expected to last one week.
- Members of each group are given packets of articles (each member's articles are unique to the group) which include one article relating to each topic the group has chosen. The articles may be from journals, book assignments, or manufacturers' literature on the topic.
- The group is given a list of questions relating to each topic. The list has several characteristics which get their attention:
 - Each topic question list has at least one unique question which can be answered from only one of the articles handed out. This forces each group member to

read his/her article on each topic if all questions are to be answered.

- The groups are told that 70% of the questions on the test covering this part of the course will come from the question list.
- The articles are not repetitious, but rather examine either different aspects of a given topic, or examine the same aspects from different viewpoints.
- The groups were also given a list of both general and specific references books and journal articles for background information.
- The groups are asked to identify a discussion leader for each topic.
- Discussions took place in the normal classroom, during the assigned class time, and the groups were encouraged to meet outside class as well. The open-ended nature of the questions which were handed out required some serious discussions to resolve unknown aspects of the topics, as well as possibly checking some of the reference material.
- The test over this material is written in a combination open-ended and closed-ended problem format, and the groups are expected to work on them as a group, although the students may turn in individual tests or one group test. Since each group selected their own four topics, each group test was usually unique.

The test was certainly one of the more interesting aspects of this technique. Open-ended tests are not common in a technical elective course, but the author felt that since each group could work on the test as a group, there needed to be a heavy demand on their thinking abilities, ideally with a series of questions which did not have "one" correct answer, but were open-ended. That is, the groups were forced to combine information out of several articles to answer each question, and were commonly required to make one or more assumptions on the way to their answer.

The demands on the instructor were considerably different during this portion of the course. The first demand was to develop a selection of references on each topic which would contain some useful information which would be unique to that selection. This would be the only way to be sure each student was truly participating. The groups were not told which question referred to which selection, but the process of elimination allowed them to rapidly determine who should know a particular piece of information.

During the discussion/class times the instructor circulated among the groups and tended to answer questions with questions, since he knew they had the answers in their material. This was obviously the fun part for the instructor. The students were encouraged to dig in their own literature as well as into the more general references.

Both the construction of the tests and their grading was a mixture of fun and dread, and consumed many more hours than a more standard test. Since many of the test questions were open-ended, construction of the questions had to be done carefully. The instructor did try to limit the number of assumptions that had to be made, as well as keep those assumptions within reasonable bounds. Grading the tests was rather time-consuming since some of the assumptions made were rather creative, but could not immediately be discredited.

TEST QUESTION EXAMPLES:

Following are examples of questions used for defibrillators in a "standard" test, and examples of questions in the essay tests.

STANDARD TEST QUESTIONS:

- Find the time constant for the following defibrillator charge circuit (standard RLC circuit follows).
- Why are defibrillator paddles correctly called electrodes?

ESSAY TEST QUESTIONS:

- Develop a design for a Low-voltage waveform defibrillator which meets the following criteria:
 - maximum of 8 second charge time under any allowable conditions of the power line and discharge energy, up to 400 J.
 - include all safety factors present in articles you have been assigned.
- Develop a circuit board layout for an electrosurgery unit output stage. Be certain the layout meets the appropriate requirements for a high-voltage board.

Results have been good. The average grades in the two semesters the group projects have been used are up 52% in the group-discussion topics, and the remainder of the semester the grades did not change from previous semesters. This resulted in a 13% increase in overall course grades compared to the semesters in which the standard lecture techniques were used. The enthusiasm generated in the group portion of the course carries over into the rest of the course with increased classroom participation by the members of the class.

Because the decision to implement this technique was done several years ago, partly out of the instructor's frustration with the more traditional teaching techniques, there was no formal assessment of the earlier classes nor any attempt to quantitatively compare the two. Since the teaching techniques were different, the material was different, and the tests were different, the best the author can report is a 52% increase in grades for that section of the course, while the grades in the rest of the course, taught in the "old" manner, remain the same.

The presentation of this material will include examples of how the techniques discussed are used, including breaking the audience into small groups, handing out examples of selected literature, and asking the groups to participate in discussion much like a classroom group is expected to.

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